

PR#9833

ZHANG, HAILIN

1/16/2008

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IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA, ex rel.
W. A. DREW EDMONDSON, in his
capacity as ATTORNEY GENERAL
OF THE STATE OF OKLAHOMA and
OKLAHOMA SECRETARY OF THE
ENVIRONMENT C. MILES TOLBERT,
in his capacity as the TURSTEE
FOR NATURAL RESOURCES FOR
THE STATE OF OKLAHOMA,

Plaintiffs,

vs.

05-CV-0329 GKF-SAJ

TYSON FOODS, INC., TYSON
POULTRY, INC., TYSON CHICKEN,
INC., COBB-VANTRESS, INC.,
AVIAGEN, INC., CAL-MAINE FOODS,
INC., CAL-MAINE FARMS, INC.,
CARGILL, INC., CARGILL TURKEY
PRODUCTION, LLC, GEORGE'S, INC.,
GEORGE'S FARMS, INC., PETERSON
FARMS, INC., SIMMONS FOODS, INC.,
and WILLOW BROOK FOODS, INC.,

Defendants.

VIDEO DEPOSITION OF HAILIN ZHANG, Ph.D.
TAKEN ON BEHALF OF THE DEFENDANTS
JANUARY 16, 2008, BEGINNING AT 9:00 A.M.
IN OKLAHOMA CITY, OKLAHOMA

REPORTED BY: Laura L. Robertson, CSR, RPR

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1 Sometimes they ask a state specialist or
2 area specialist to give a presentation on particular
3 topics. So I have been involved in some of these
4 trainings as well.

5 Q. And you said you developed half of the nine
6 hour program. Who else was involved in that program?

7 A. It is a team effort, like Mike Smolen,
8 Dr. Mike Smolen, Dr. Doug Hamilton, Dr. Jim Britton,
9 he left Oklahoma State University. Then many county
10 extension, we call educators, or area economic
11 specialists.

12 Q. In what part of this nine hour program were
13 you responsible for developing?

14 A. Mostly directly related to land application
15 poultry litter. Like how to take a soil sample, how
16 to analyze poultry litter, how much to apply, when to
17 apply, what kind of best practices are needed to
18 prevent nutrient loss from field received poultry
19 litter.

20 Q. Aside from transferring that program from a
21 PowerPoint to a DVD at some point, have you modified
22 the portion that you prepared, you initially prepared
23 in any way over time?

24 A. No, we have not revised it, since it
25 transformed to a DVD.

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1 Q. Well, had you revised it at any point
2 whenever it was on PowerPoint? In other words, you
3 prepared a PowerPoint eight or nine years ago?

4 A. Right.

5 Q. At any point in time, were you making
6 modifications or tinkering with that PowerPoint?

7 A. No. We just give updates during our three
8 hours training, if there is new information available.

9 Q. Verbal updates?

10 A. Verbal or written, like fact sheets, some
11 other extension compilations.

12 Q. So if it was in writing, it would be
13 typically, are you saying it would be in the form of a
14 facts sheet, an extension service facts sheet?

15 A. Right, uh-huh.

16 Q. When it was transferred from PowerPoint to
17 DVD or modifications made at that point, other than in
18 the manner that the information was delivered, rather
19 than being on PowerPoint, it was now on DVD, did you
20 change any of the substantive information?

21 A. There was no substantial change, except in
22 the form of delivery.

23 Q. Okay. When it was a PowerPoint, would you
24 actually go in person and present the PowerPoint, or
25 would someone else -- did the county extension agents,

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1 for example, have that PowerPoint available to them
2 and they could just show your PowerPoint?

3 A. The county personnel did majority of the
4 direct training to producers, but we trained them
5 first. We call that training the trainers, basically.
6 So we had annual meetings to prepare our county
7 personnel to do their training.

8 Q. Are you still involved in training the
9 county extension service folks?

10 A. Yes.

11 Q. Would that include initial training for new
12 county agents; in other words, if they employed
13 someone today, would you be involved at some point
14 potentially in training that person?

15 A. Yes, I think so.

16 Q. And is that involvement simply through they
17 view the information that you have put together, or
18 you actually personally at some point interacting with
19 new county extension agents to train them?

20 A. We all go through the nine hour training
21 with them, but they have their DVD and we have shorter
22 sessions to, just to bring them up-to-date. If they
23 have questions, they can contact us any time.

24 Q. With regard to county agents in the Illinois
25 River Watershed, would you also be involved in

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1 training those county agents?

2 A. Yes.

3 Q. And that would include the availability of
4 this nine hour DVD and also these personal training
5 sessions, periodic training sessions you have
6 described?

7 A. Right.

8 Q. How often do you conduct or participate in
9 training sessions for county extension agents, in
10 other words, in training the trainers as you have put
11 it?

12 A. Annually? Probably once or twice a year.

13 Q. Would those occur on any type of regular
14 basis; in other words, is it always in January and
15 June, or can it just vary?

16 A. Varies. It is not fixed on a particular
17 time.

18 Q. Are there also update sessions or continuing
19 education sessions that you're involved in for county
20 extension agents who have already gone through the
21 initial training process?

22 A. Yes.

23 Q. Do these occur at the same annual or
24 semiannual meetings you have already described?

25 A. Yes. Normally they come together. Whether

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1 it is their new or old. So they do need some refresh
2 course.

3 Q. But these types of meetings are separate and
4 distinct from your participation from time to time in
5 meetings and updates for poultry operators or litter
6 applicators; correct?

7 A. We don't particularly target a specific
8 watershed or specific species of animals. So we give
9 them general training in nutrient management or animal
10 waste. People from Guymon or any place in the state
11 are welcome to participate in that.

12 But of course most of agents from eastern
13 part of the state always attending those meetings.

14 Q. So when you train county extension agents or
15 are involved in their training, it is dealing with
16 manure from all different types of animals?

17 A. Right.

18 Q. And what specifics with regard to animal
19 manure are you training them on whenever you are
20 involved in these meetings, either, you know, whether
21 it is to -- I understand you said they are all
22 together, but whether it is refresher for somebody
23 who's already been an extension agent or whether it is
24 an initial training session for a new agent, what
25 specifics are you dealing with in that training

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1 with land application?

2 A. Right.

3 Q. And I think you said soil samples, litter
4 analysis, how to apply, when to apply and best
5 management practices?

6 A. Right. Basically those are the components
7 of nutrient management plan. So we try to help them
8 how to develop a nutrient management plan, how to
9 follow or understand nutrient management plans.

10 Q. Do you have an opinion about whether poultry
11 litter, let's just talk about poultry litter, has an
12 agricultural value to a farmer?

13 A. Yes, I do. Poultry litter contain
14 nutrients, organic matter. So it is a beneficial
15 by-product to agriculture.

16 Q. And I asked you about an agricultural value.
17 Do you have an opinion about whether it has an
18 economic value to a poultry grower?

19 A. Just to poultry grower?

20 Q. Or to someone who might use poultry litter
21 on their land.

22 A. It depends on distance. If it is close
23 enough, yes, there is economic benefits. If it has to
24 be transported too far, they may lose that benefits.

25 Q. Have you ever attempted to calculate or do

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1 you feel like it is within your bailiwick, so to
2 speak, on any type of opinion about the amount of
3 poultry litter that's generated in the Illinois River
4 Watershed?

5 A. No.

6 Q. And the same question with regard to the
7 amount of poultry litter that's land applied in the
8 Illinois River Watershed, either historically or
9 currently, have you ever attempted to calculate that?

10 A. No.

11 Q. Have you ever attempted to calculate the
12 amount of poultry litter that's transported out of the
13 Illinois River Watershed, either historically or
14 currently?

15 A. No. We don't do actual work just for
16 watershed, so I don't have any information pertaining
17 to a specific area. State-wide responsibility is what
18 we are taking.

19 Q. Well, have you ever attempted to calculate
20 the amount of poultry litter generated in the state of
21 Oklahoma?

22 A. I didn't. We just got the statistics from
23 Oklahoma Department of Agriculture, I think, and they
24 have a summary sometimes they send to us, I don't
25 know. I have not attempted to calculate.

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1 whole state of Oklahoma?

2 A. I don't remember exactly.

3 Q. Well, as opposed to it being like for a
4 specific watershed?

5 A. I knew for sure it is not by watershed.

6 Q. Okay. Have you ever attempted to calculate
7 the value in terms of commercial fertilizer
8 equivalencies of the nitrogen that's contained in
9 poultry litter?

10 A. Yes, I did.

11 Q. And do you have any opinions in regard to
12 that?

13 A. To the value of nitrogen in the poultry
14 litter?

15 Q. Right. In terms of commercial fertilizer
16 equivalency?

17 A. Yes.

18 Q. What is your opinion in that regard?

19 A. Poultry litter typically contains about 60
20 pounds of nitrogen per ton. Currently the nitrogen,
21 commercial nitrogen, costs about 50 cents a pound. So
22 that would be equivalent to close to \$30 a ton, just
23 for nitrogen.

24 Q. What about with regard to phosphorous, the
25 same question with regard to phosphorous?

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1 A. Yes, we can do the same calculation.
2 Poultry litter contains about also 60 pounds phosphate
3 per ton. Phosphate, it may cost about 40 cents a
4 pound right now, I don't know exactly. It changes
5 every day. So the value could be over 20 a ton for
6 phosphorous.

7 Q. Have you ever attempted to calculate the
8 cost of transporting poultry litter over any
9 particular distance on a per mile basis or some other
10 basis?

11 A. I have not. But somebody did calculation, I
12 don't remember who did it. Estimated \$2 per mile per
13 Mack truck. That's some number stuck in my mind, but
14 that's several years ago. Now the gas and oil price
15 went up, probably that no longer holds.

16 Q. So you think that's probably gone up?

17 A. I think so.

18 Q. Do you have any idea who it was that
19 prepared that information that you recall seeing, the
20 two dollars per mile per Mack truck?

21 A. I don't recall.

22 Q. Was it someone at Oklahoma State?

23 A. I don't remember. Must be an economist.

24 Q. Okay. Do you know how long ago it was that
25 you saw that, you said several years?

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1 A. Yes, that's over five years ago.

2 Q. Okay. Do you have any estimate of how much
3 a Mack truck would hold, how much litter?

4 A. 20 to 25 tons per truck.

5 Q. Does the weight of poultry litter vary?

6 A. Yes. Depending on the moisture content or
7 how compact it is.

8 Q. Does it depend on what type of bird is being
9 raised in the particular poultry house?

10 A. I think so. Also depend on the ratio of how
11 much bedding material they use. Different birds may
12 create some difference, too, like a lay hen might be
13 different from a boiler chicken litter. But I don't
14 have specific number for them.

15 Q. In your opinion, based on your experience of
16 poultry litter, if one was attempting to calculate the
17 tonnage of poultry litter in a particular area, would
18 they have to account for these factors, moisture
19 content and the type of bird and how compact it is and
20 those types of factors you have listed?

21 A. No, they just need to analyze the litter,
22 and then take the as-is value, so not correcting for
23 moisture and other variabilities.

24 Q. Well, I guess my question is, for example,
25 if someone is trying to calculate the amount of

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1 poultry litter for an entire watershed, are these
2 factors you have listed, moisture, compactness, type
3 of different birds, are those things that ought to be
4 accounted for in some fashion?

5 A. Yes, if they want to get accurate account,
6 uh-huh.

7 Q. If growers in the Illinois River Watershed
8 or anywhere in Oklahoma, could no longer use litter in
9 any respect, land application of litter, do you have
10 an opinion about what the value of poultry litter
11 would be in that particular area at that point? Would
12 it have any value?

13 A. To other farmers?

14 Q. Let's talk about economic value to the
15 poultry grower, if that poultry grower can no longer
16 spread the litter, does it any longer have any
17 economic value for him?

18 A. No. If -- unless they find alternative use.
19 They could use as an energy source or do something
20 else to market it. Otherwise there is no value as a
21 nutrient source, if they cannot apply.

22 Q. Are you aware of any current economically
23 feasible alternative uses of poultry litter in
24 Oklahoma, other than using it as a fertilizer, as it
25 stands right now?

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1 A. No, I'm not aware of any.

2 Q. We have talked about the cost of
3 transporting it and some numbers that you saw quite
4 some time back. Is there any such alternative use
5 within what you would consider a reasonable distance
6 to transport poultry litter from the Illinois River
7 Watershed?

8 A. Well, Illinois River Watershed is a big
9 watershed. I don't know where to start. But in my
10 opinion, you should not transport more than 100 miles
11 from the source. If you do, you may lose the value of
12 that.

13 Q. And are you aware of any alternative sources
14 of, or uses of poultry litter within 100 miles of that
15 area, as you sit here right now? I know you haven't
16 researched it.

17 A. Well, there are plenty of lands that
18 actually need phosphorous, even in the Illinois River
19 Watershed, or surrounding areas. They just need to
20 test the soil, find out where the phosphorous is.

21 Q. So you believe that there are within the
22 Illinois River Watershed other -- let's use a
23 hypothetical. If I'm a poultry grower and my nutrient
24 management plan does not allow me to put poultry
25 litter on my particular farm, are you telling me that

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1 determined by phosphorous, the phosphorous level in
2 poultry litter?

3 A. It is based on soil testing, the field
4 conditions first whether they can apply or cannot
5 apply. And then based on the phosphorous of the
6 poultry litter, to determine how much they can apply.

7 Q. When you say soil test and field conditions,
8 is that also the phosphorous level in the soil in that
9 field?

10 A. Yes, mostly.

11 Q. As opposed to some other nutrient, I'm
12 saying?

13 A. Right. The other field conditions may
14 apply, too, such as slope. If it is a greater than 15
15 percent, it is not allowed to apply. If it is too
16 shallow or the groundwater level is too high. If it
17 is a frozen ground or snow covered, also not allowed
18 to apply.

19 Q. But just discussing nutrients, is the
20 phosphorous level in the soil and the litter what
21 governs in the nutrient management plan, whether or
22 not they can put down litter and how much litter they
23 can put down?

24 A. According to NRCS 590 standard, yes, that's
25 correct.

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1 Q. And that's the Oklahoma NRCS 590 standard?

2 A. Right, it is called Nutrient Management
3 Guidelines.

4 Q. And that has also been incorporated into the
5 Oklahoma law; correct?

6 MR. NANCE: Object to the form. Calls for a
7 legal conclusion.

8 Q. (BY MR. GRAVES) To your knowledge, has that
9 been incorporated into Oklahoma law?

10 MR. NANCE: If you know the answer, you can
11 give it.

12 THE WITNESS: I don't know the relationship
13 of that, but Oklahoma Department of Agriculture
14 accepts that standard, I think.

15 Q. (BY MR. GRAVES) Okay. To your knowledge,
16 the plan writers in Oklahoma, do they use 590 in
17 developing the nutrient management plan?

18 A. They should.

19 Q. When you train the plan writers, is that
20 590, those 590 standards part of what you train them
21 on?

22 A. Part of it. But we basically train them
23 from the economic point of view what they should do,
24 and then also to comply with regulations.

25 MR. GRAVES: I don't know how far we are on

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1 A. The plan is specific for individual producer
2 or poultry farmer. So the developer or plan writer
3 would inspect the fields and make some
4 recommendations.

5 Q. And are --

6 A. And what BMP to use.

7 Q. So are they looking at how deep the soil is,
8 how rocky the soil is, how steep the topography is,
9 all of those things you have just listed, are those
10 things that they are looking at, whether or not they
11 actually end up applying to that particular plot of
12 land?

13 A. They should consider those factors. Those
14 information should be available from a soil map.

15 Q. And then the other things you mentioned, the
16 timing and the soil and litter testing, in those types
17 of issues are all things that are also included within
18 the plan writing process; correct?

19 A. Yes.

20 Q. Are there any best management plan
21 considerations that you're aware of that are not at
22 least considerations in the plan writing process for
23 nutrient management plan?

24 A. Could you repeat your question?

25 Q. Are you aware of any -- of what you would

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1 BY MR. MCDANIEL:

2 Q. Good afternoon, Dr. Zhang.

3 A. Good afternoon.

4 Q. I'm Scott McDaniel and I'm an attorney and I
5 represent Peterson Farms, Inc. My objective is going
6 to be to not re-cover the same topics that you covered
7 with Mr. Graves, but I may to a little bit extent jump
8 around.

9 So I would appreciate a little patience
10 bearing with me, because I want to hit on a couple of
11 topics that you may have talked about, but maybe I
12 have additional question or two that I would like to
13 address.

14 Let me hand you what I have marked as
15 Exhibit 9 to your deposition, and I pulled that down
16 off of your web page at OSU, and I'm offering it.
17 You and Mr. Graves have already talked about your
18 educational experience and your background and your
19 job titles at OSU, I just want to ask you if these
20 three pages accurately reflect your work experience,
21 your educational attainment and your position at
22 Oklahoma State University.

23 (Exhibit 9 marked for identification)

24 A. Yes.

25 Q. All right. Go ahead and set that aside

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1 then, thank you. You made a statement in the last few
2 moments you were talking with Mr. Graves, and you said
3 that you recommend that poultry litter be utilized as
4 a fertilizer and applied at agronomic rates. Am I
5 quoting you accurately?

6 A. Yes.

7 Q. All right. The poultry litter contains a
8 number of substances that are beneficial to either
9 plant life or to the soil. Would you agree?

10 A. I agree.

11 Q. Can you go through and list, I think we are
12 all familiar with the, what are called the
13 macronutrients or primary nutrients, nitrogen,
14 phosphorous and potassium.

15 Beyond that, what are the additional
16 components of poultry litter that are either
17 beneficial to growing crops or the soil structure
18 itself?

19 A. Well, plants need 16 essential nutrients to
20 grow. Poultry litter contains all of these 16,
21 including those macronutrients you mentioned, such as
22 secondary nutrients, calcium, magnesium, sulphur,
23 micronutrients, copper, zinc, iron, boron, manganese,
24 carbon, hydrogen, oxygen. Those are -- plants can get
25 from water and air.

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1 Q. Right.

2 A. In addition, soil organic matter would
3 improve soil quality and enhance plant growth.

4 Q. The organic matter that is in poultry
5 litter?

6 A. Yes.

7 Q. In a general sense, what comprises the
8 organic matter in poultry litter?

9 A. The building materials, whether it is wood
10 shavings, sawdust, they are organic matters. The
11 feces, urines do contain other organic compounds, too.

12 Q. All right. The compounds that you
13 identified and you listed for us, those can be
14 utilized by growing plants; is that correct?

15 A. The nutrients, yes.

16 Q. All right. But poultry litter improves the
17 structure of soil and its ability to yield crops in a
18 number of ways; is that true?

19 A. Yes.

20 Q. Can you describe what other mechanisms are
21 at play that allow poultry litter to provide
22 improvements to the soil structure?

23 A. By adding organic matter to the soil would
24 improve soil structure. Poultry -- those organic
25 matters also help retain more water, improve soil

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1 moisture conditions.

2 So basically it is the rule of organic
3 matter improving soil structure.

4 Q. All right. I have read some papers and I
5 have seen the statement that organic fertilizer such
6 as poultry litter improves the tilth, t-i-l-t-h, of
7 soil. Can you tell us what that term means?

8 A. Tilth means, it is usually means to
9 cultivate tilth. It has a bit of structure, like
10 granule structure, it is easy to work with.

11 Q. Put in simple terms, if I was plowing the
12 field, if it had good tilth, I could pull my plow
13 through it easier and turn the soil easier, is that
14 what you're suggesting?

15 A. Correct.

16 Q. Okay. So if you were -- if you take soil
17 analysis of a field in order to evaluate whether to
18 utilize poultry litter, or if so at what rates to
19 utilize the poultry litter, is it conceivable that
20 there could be plenty of copper or calcium in the
21 soil, but the soil could be deficient in phosphorous
22 or potassium and therefore the poultry litter could
23 provide a benefit if it was applied?

24 MR. NANCE: Object to the form. Calls for
25 speculation.

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1 Q. (BY MR. MCDANIEL) It is a hypothetical. Do
2 you understand my question?

3 A. Repeat it again.

4 Q. All right. Let me try approaching it in a
5 way that maybe is clearer, if I'm being confusing.

6 If you want to raise a crop or forage, for
7 instance, let's just say Bermuda grass, for example,
8 since that's common in eastern Oklahoma and western
9 Arkansas, is that true, is that a common pasture
10 grass?

11 A. Yes.

12 Q. And as a soil scientist and your expertise
13 in agronomy, you know in order to maximize the yield
14 for Bermuda grass, the soil should have a certain
15 chemical profile, there would be an optimal chemical
16 profile to get the optimal yield; is that true?

17 A. Yes.

18 Q. All right. And what we are talking about
19 today is, in nutrient management planning, we are
20 trying to balance the desire to get the maximum yield
21 against the need to protect natural resources from
22 contamination. Is that from a policy standpoint,
23 that's what your practice involves?

24 A. Correct.

25 Q. All right. All right, poultry litter you

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1 said provides all 16 --

2 A. Nutrients.

3 Q. Nutrients?

4 A. Uh-huh.

5 Q. In our discussion, we have talked almost
6 exclusively about phosphorous. And what the
7 questions, or what I want to inquire about, sir, is it
8 conceivable that poultry litter is meeting agronomic
9 needs to improve the yield of that crop in some of the
10 other 15 nutrients besides phosphorous; correct?

11 A. Correct. The plants can benefit any of the
12 16 if the soil cannot supply it. If you -- plants
13 need a different amount of those 16 nutrients. If you
14 base one nutrient to apply poultry litter, you may
15 overapply some other nutrients.

16 Q. That's my point exactly. Now, in our
17 discussion we have talked about phosphorous being that
18 limiting nutrient for environmental reasons; correct?
19 That's why we talk about phosphorous is out of concern
20 for water resources?

21 A. Correct, for surface water quality.

22 Q. All right. If -- I'm trying to understand
23 what agronomic rate really means in your business.
24 If -- if you determined that the soil had sufficient
25 potassium in the soil, therefore the potassium

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1 treatments with poultry litter, two tons per acre and
2 four tons per acre.

3 So if you look at that column, tons per
4 acre, the last column is the protein percentage, okay.
5 So the yields refer to the middle column. They were
6 higher with poultry litter than commercial fertilizer.

7 It is not exactly the same amount of
8 nitrogen the quality referred to the protein content.
9 The poultry litter treated plots had a higher protein
10 content than controlled -- than ammonium nitrate
11 fertilizer fields.

12 Q. Okay. If this Bermuda is for grazing beef
13 cattle, is an increased protein content a good thing?

14 A. Yes, protein is important ingredient of food
15 for cattle.

16 Q. I noticed in looking at that table 3 where
17 there was the application at two tons per acre
18 produced 3.54 tons per acre of Bermuda; is that
19 correct?

20 A. Yes.

21 Q. When the application went to four tons per
22 acre, the yield increased to 4.82 tons?

23 A. Yes.

24 Q. All right. You can set that aside, sir.
25 Dr. Zhang, let me hand you what I have marked as

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1 A. Yes.

2 Q. Would you agree, Dr. Zhang, that that is a
3 site specific question?

4 A. Correct. That in order to -- for the
5 phosphorous to get into water, there must be two
6 conditions met. The source factor, the high
7 phosphorous in the soil and the transport factor. So
8 some mechanism to carry phosphorous from the soil to
9 the water. If you just have a source, no transport
10 mechanism, maybe it is not going to impact the water.

11 Q. Is sediment from erosion a significant
12 source of phosphorous loading of surface waters?

13 A. Not in pasture area. For cultivated fields,
14 yes. For pasture, mostly water soluble phosphorous.

15 Q. And is part of the reason for that answer
16 because pasture has a stand of grass that reduces
17 surface water movement, reduces erosion?

18 A. Right.

19 Q. And transport?

20 A. Yes.

21 Q. If pastures are not maintained and
22 fertilized in order to maintain a good stand of forage
23 and it is allowed to degrade, is there an increased
24 risk of increased sediment loss from those fields?

25 A. Yes.

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1 Q. And would that have a adverse environmental
2 impact on the waters of the state?

3 A. Yes.

4 Q. Sir, Dr. Zhang, as the State's Nutrient
5 Management Specialist, have you come to an opinion
6 that the land application, the practice of land
7 applying poultry litter in the Illinois River
8 Watershed should be banned 100 percent?

9 A. Well, from the agronomic point of view, if
10 the soil test indicates there is a need for nutrients,
11 no, they should not be banned. If all of the
12 nutrients are met, I mean maybe some fields it could
13 be avoided to apply.

14 Q. All right. To your knowledge, sir, has
15 Oklahoma State University issued any opinion or made
16 any determination that the practice of the land
17 application of poultry litter in the Illinois River
18 Watershed should be banned?

19 A. No. I'm not aware of any.

20 Q. You said this morning that you had an
21 opportunity to review an affidavit prepared by
22 Dr. Gordon Johnson?

23 A. Yes.

24 Q. Did you consult with Dr. Johnson at all in
25 the work he conducted in order to prepare that

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1 MR. GRAVES: Object to the form.

2 Q. (BY MR. NANCE) Is that the eutrophication
3 that we talked about before?

4 A. Improper use can result in environment
5 damage. Eutrophication is one of them, yes.

6 Q. All right. Professor, let's turn over to
7 page 2 real quickly. Do you see in the left-hand
8 column the bolded heading Why Does Soil P Increase?

9 A. Yes.

10 Q. Let me read the first sentence and then
11 let's talk about that. "In many areas of intensive
12 livestock and poultry production, manure normally is
13 applied at rates designed to meet crop nitrogen in
14 requirements." Did I read that correctly?

15 A. This was true at the time when this was
16 written.

17 Q. Okay. First of all, tell me what you mean
18 when you say meet crop nitrogen requirements, and then
19 we will talk about how it has changed?

20 A. They calculate application rates based on
21 how much nitrogen the crop need, instead of based on
22 phosphorous needs of the crop to calculate how much
23 poultry litter to apply.

24 Q. Okay. And how has that changed since this
25 was written?